OBSERVATIONS ON THE LEUCOCYTIC BLOOD PICTURE IN BENIGN TERTIAN MALARIA WITH REFERENCE TO THE VALUE OF THE LARGE MONONUCLEAR COUNT AS AN AID TO DIAGNOSIS.

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A study of the recent literature as to the relative percentage of the various leucocytes in Malaria shows a remarkable confliction of opinion, even amongst recognised observers. Manson's Tropical Diseases, 7th Edition, states "The work of many observers tends to show that the leucocytes are increased during the actual malarial paroxysm, and subsequently become diminished. After the malarial attack they again become normal, or there may be a relatively small leucocytosis with an increase of the large mononuclear cells above 15 per cent. The greatest increase of these cells is during the apyrexial periods."

Fairley and Hamilton as a result of 1135 cases amongst Australians in Egypt and Palestine found the average leucocyte percentage was Polymorphs= 53: Lymphocytes= 25: Large Mononuclears plus Transitionals= 21:

Esquier working at Dakur in Senegal in 25 cases of malaria found Polymorphs= 64·2-86·2: Small Mononuclears= 4·2-13·4: Large Mononuclears= 1·8-6. This worker especially emphasises the Polymorphonuclear increase. Kop writing from the Central Military Laboratory, Java, concludes that taking into consideration only the Large Mononuclear and Transitional leucocytes there is not often in malaria a mononucleosis of over 15 per cent and that the high counts reported are due to the inclusion of Large Lymphocytes. He finds, however, that a shift to the left of the Arneth count, that is a diminution in the number of nuclear lobes possessed by the Polymorpho-nuclear, is a constant and persistant symptom of malaria and indicates that there is a likelihood of a relapse. These divergent results can be attributed to two factors.

I. Lack of uniformity in the compilation of statistics.

II. Differences of technique.

I. A common method is for observers to compile statistics from their findings in a large number of blood smears containing malarial parasites; ignoring the fact that many of the cases are complicated by Liver abscess, Kala Azar, Tuberculosis and Syphilis.

II. Differences of Technique.

a. Smears taken at all times of the day and

no allowance made for the lymphocytosis after food.

b. The technique of taking the film and choice of site of puncture.

c. Unequal distribution of leucocytes in smear.

d. The results of quinine administration.

The varying results arising from differences in technique are so marked and the pitfalls in doing a differential count so little emphasised in most text books that the main ones are worth discussion.

(b) CHOICE OF SITE OF PUNCTURE.

Lucey has pointed out that the first drop of blood taken from the ear of a normal person, whose venous blood showed a Large Mononuclear percentage of seven, contained from 35-41% of large monomuclears. He concluded that in the ear, owing to its inactive circulation, the large monomuclears tend to stagnate and cling to the capillary walls as after massage, friction etc., the percentage approached the normal one.

(c) UNEQUAL DISTRIBUTION OF LEUCOCYTES IN SMEAR.

Stephens, Yorke, Blacklocke etc. in an interesting article on the value of the Differential leucocyte count show what fallacies can occur from the unequal distribution of leucocytes on a film. Rogers states that an excess of Polymorphonuclears will be found along the edges and in the distal tags and of lymphocytes in the centre.

My own practice has been to count 100 leucocytes along the edge and 100 in the centre of the film and to show the difference in distribution the following table, taken at random on a day's counts, is given.

	P.	S.L.	L.L.	L.M.	B.	E.
Count along edge Newlands 12-8-22.	74.	7.	5.	12.	0.	2.
ditto centre	44.	43.	6.	4.	1.	2.
Count along edge Necklen 12-8-22.	68,	11.	7.	14.	0.	0.
ditto centre	61.	29.	1.	6.	2.	1.
Count along edge Drane 12-8-22.	50.	20.	11.	14.	0.	5.
ditto centre	33.	55.	6.	2.	0.	4.
Count along edge Duncan 12-8-22.	72.	13.	5.	6.	0.	4.
ditto centre	27.	52.	1D.	7.	0.	4.

My own observations conform with Roger's statement; namely that the Polymorphonuclears

predominate along the edges and the lymphocytes in the centre of the film;but I have repeatedly noticed that this applies especially to the Small Lymphocytes;the Large Lymphocytes and Large Monomuclears being found in greater numbers along the edges.

(d) RESULTS OF QUININE ADMINISTRATION.

In Cushing's Pharmacology it is stated according to Roth that the effect of a single dose of quinine is.

1.Leucocytosis(Lymphocytes relatively increased).
2.Leucopenia (especially Lymphocytes).
3.Leucocytosis (Lymphocytes reduced).

The effect of continuous quininisation on the leucocyte count in normal human beings, I attempted to estimate by giving five volunteers 20 grs.of quinine a day for eight days and the results are recorded in the table attached.

TECHNIQUE USED IN THE EXAMINATION OF CASES SELECTED.

Six cases of Benign Tertian Malaria were selected for these observations. Agglutination, Wassermann and stool examinations were carried out in each case with negative results. The Blood Smears except where stated to the contrary were taken between 10-12 a.m. daily. The site of puncture selected was the lobe of the ear,the first two drops of blood being discarded. Two hundred leucocytes was the minimum counted,half along the edge of the smear and the remainder in the centre. Large mononuclear and Transitional leucocytes were counted together under the title of Large Monomuclears.

TABLE I.

Five volunteers were given 20 grs.of Quinine Hydrochloride daily. They were all suffering from Chronic Gonococcal urethritis but were free from any complications such as Prostatic abscess, Epididymitis etc.which might complicate the Blood Picture.

DATE.	P.	S.L.	L.L.	L.M.	B.	E.	Quinine given daily.
16th	60•7.	24•7.	5•6.	5•9.	•8.	2•3.	-
17th	62•6.	24•7.	5•6.	5•8.	•2.	•8.	10 grains.
18th	60•5.	27•7.	3•7.	6•8.	•5.	•9.	20 grains.
19th	56•1.	32•4.	2•1.	7•7.	•4.	1•3.	20 grains.
20th	57•6.	29•7.	4•0.	7•2.	-.	1•2.	20 grains.
21st	58•7.	23•0.	5•5.	10•8.	•6.	1•2.	20 grains.
22nd	58•6.	25•9.	3•6.	9•3.	•4.	2•2.	20 grains.
23rd	60•5.	26•6.	3•5.	8•0.	•5.	1•7.	20 grains.
24th	53•3.	28•7.	3•1.	12•5.	•3.	2•0.	20 grains.
25th	57•5.	26•6.	4•2.	10•1.	•5.	0•8.	Nil.

The Table was compiled by dividing the daily aggregate by five, the calculation,for simplicity sake,being carried to only one decimal point.

CASE I.

DRANE R.J. First attack of Benign Tertian Malaria in May 1920 at Lahore. Second attack June 1921. Arrived in England May 1922. The present attack commenced at Uxbridge on the 9-7-22. On admission temperature 100. Spleen+ .Quinine grs.xxx had been given in last 24 hours.

"W.C.C.=White Cell Count: S.L.=Small Lymphocytes: L.L.=Large Lymphocytes: L.M.=Large Mononuclears: B.=Basophil: E.=Eosinophil"

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
10.7.22.	-	36.	13.	38½.	10½.	½.	1½.	8 Gametes.	
11.7.22.	6000.	41⅓.	12⅓.	41⅓.	4⅓.	⅓.	⅓.	3 Gametes.	·45 grm. "914"
12.7.22.	4800.	40½.	16½.	33½.	7½.	½.	1½.	3 Gametes. 2 Shizonts.	
13.7.22.	4000.	28.	21.	32.	17½.	-.	1½.	" " "	
14.7.22.	4200.	28.	15½.	34.	21½.	-.	1.	2 Shizonts.	
15.7.22.	5200.	18.	31.	30.	19.	-.	2.	No parasites detected.	
16.7.22.	5400.	22.	4.	46.	22.	4.	2.	1 Gamete.	
18.7.22.	3200.	47.	12.	31.	6.	2.	2.	No parasites detected.	·45 grm. "914"
19.7.22.	5000.	51.	16½.	21½.	10.	-.	1.	" " "	
20.7.22.	6400.	61.	11⅓.	18.	8.	1.	½.	" " "	
21.7.22.	5200.	28½.	35½.	29½.	5½.	-.	1.	" " "	
22.7.22.	- .	35½.	26.	29.	7.	½.	2.	" " "	
23.7.22.	5600.	51.	14.	28½.	6.	-.	½.	" " "	
24.7.22.	8000.	40⅓.	28⅔.	24⅔.	5.	⅓.	1.	" " "	
25.7.22.	- .	37½.	41.	16½.	2.	1.	2.	" " "	·45 grm. "914"
26.7.22.	8400.	40.	20½.	30.	6½.	2.	1.	" " "	
27.7.22.	8800.	40.	23.	29.	3.	½.	4½.	" " "	
28.7.22.	7400.	40.	16.	38.	4.	-.	2.	" " "	
29.7.22.	7200.	43.	42.	10½.	2½.	-.	2.	" " "	
30.7.22.	9200.	24.	44.	27.	2.	2.	1.	" " "	
	Quinine Hydrochloride grs.xv a day.								
31.7.22.	4400.	41.	33½.	15½.	5½.	2.	2½.	" " "	Quinine grs. xv.
1.8.22.	- .	42.	24½.	30½.	-.	1.	2.	" " "	·45 grm. "914"
2.8.22.	7400.	55½.	30½.	6.	3½.	½.	4.	" " "	
3.8.22.	12200.	49½.	30½.	10.	4.	1.	5.	" " "	
4.8.22.	10600.	43.	23.	20.	7.	-.	7.	" " "	
5.8.22.	7200.	59.	18.	6.	11.	2.	4.	" " "	
6.8.22.	9400.	52.	29.	12.	6.	1.	-.	" " "	Quinine grs. xv a day.
7.8.22.	7800.	47.	44.	1.	4.	1.	3.	" " "	Iron Tonic.
8.8.22.	9800.	52.	33.	7.	6.	1.	1.	" " "	·45 grm. "914"
9.8.22.	7400.	56.	18.	14.	6.	2.	4.	" " "	
10.8.22.	10400.	64.	8.	15.	8.	-.	5.	" " "	

CASE I. DRANE R.J.(contd.).

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
11.8.22.	9200.	54.	17.	10.	13.	3.	3.	No parasites detected.	
12.8.22.	6400.	41½.	37½.	8½.	9.	-.	4½.	" " "	
13.8.22.	6200.	52.	39.	3½.	4½.	-.	1.	" " "	
14.8.22.	5800.	53.	34.	7.	4½.	½.	1.	" " "	
	Discharged to duty having gained 14 lbs in weight. To take quinine grs.x a day and report in one month's time for injection of "914."								
16.8.22.	-	68.	20.	1½.	3½.	½.	6½.	No parasites detected.	.45 grm. "914."

CASE II.

NEWLANDS F.G. Arrived in India March 1921. Malaria, Benign Tertian, found on 27-4-21. Arrived in England 9-12-21. Had several relapses on leave. Admitted 17-7-22. Has had quinine prior to admission.

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
17th 7-22.	-	29⅓.	13⅓.	25⅔.	30.	⅔.	1.	1 Ring. 1 Shizont.	-
18th	5400.	55½.	10½.	21.	9½.	1½.	2.	No parasites detected.	·45 grm. "914."
19th	6400.	62.	8½.	14½.	11½.	1½.	2.	" " "	
20th	8400.	72.	7.	11.	8.	1⅓.	⅔.	" " "	
21st	7200.	36.	23½.	32.	7½.	½.	1½.	" " "	
22nd	6000.	19.	67.	10½.	3.	-	½.	" " "	
23rd	9000.	49½.	14½.	25.	10.	1.	-.	2 Shizonts.	Complains of headache.
24th	8000.	50½.	25½.	17.	5½.	½.	1.	2 Rings.	
25th	7200.	48.	26.	15½.	6½.	2½.	1½.	No parasites detected.	·45 grm. "914."
26th	8200.	35.	32½.	27.	4.	1.	½.	" " "	
27th	6400.	53½.	13.	19½.	9.	4.	1.	" " "	
28th	-	57½.	16.	18½.	7½.	-.	½.	" " "	
29th	7200.	59.	15½.	15½.	8.	½.	1½.	" " "	
30th	9400.	49½.	35.	8½.	5½.	1.	½.	" " "	
From 30-7-22 Quinine Hydrochloride grs.xv a day.									
31st	10200.	51½.	33.	11½.	2½.	1.	½.	" " "	
1st 8-22.	-	60½.	15½.	17½.	3½.	1½.	1½.	" " "	
2nd	6800.	58½.	21½.	9.	9.	1.	1.	" " "	
3rd	-	53.	18.	17½.	10.	-.	1½.	" " "	
4th	9800.	33.	59.	4.	4.	-.	-.	" " "	
5th	-	23.	48.	20½.	7½.	1.	-.	" " "	
6th	7200.	48.	25.	17.	9.	-.	1.	" " "	
7th	8400.	48.	29.	6.	12.	1.	4.	" " "	
8th	7800.	37.	49.	7.	4.	1.	2.	" " "	·45 grm. "914."
9th	6800.	74½.	6.	5½.	11.	1½.	1½.	" " "	
10th	7200.	46.	26.	16.	9.	1.	2.	" " "	
11th	8200.	64½.	12½.	14½.	7½.	1.	-.	" " "	
12th	10200.	59.	25.	5½.	8.	½.	2.	" " "	
13th	8400.	46.	38.	6.	7.	1.	2.	" " "	

Discharged to duty having gained 10 lbs in weight.

CASE III.

NECKLEN George. 5-5-21 Pyrexia whilst at Karachi, India. 10-8-21 a second Pyrexia. Invalided home from India as D.A.H. Arrived home in England 23-3-22. Blood film negative to malaria. On 29-6-22 Pyrexia. Film taken showed B.T.parasites present. Has had quinine prior to admission.

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
17.7.22.	-	52.	18.	19½.	9½.	½.	½.	No parasites detected.	
18.7.22.	9400.	39½.	37½.	15.	7.	1.	-.	" " "	
22.7.22.	8000.	55.	22½.	17½.	4.	-.	1.		
23.7.22.	10500.	53½.	14.	23.	7½.	½.	1½.	2 Rings.	
24.7.22.	10000.	58½.	20½.	12.	7.	½.	1½.	3 Rings.	
25.7.22.	5600.	24½.	19.	52½.	3½.	-.	½.	No parasites detected.	.45 grm. "914."
26.7.22.	6000.	61½.	22.	12.	3½.	-.	1.	" " "	
27.7.22.	10000.	46½.	24.	24½.	3½.	½.	1.	" " "	
28.7.22.	-	65½.	16.	16.	2.	-.	½.	" " "	
29.7.22.	8400.	63.	22½.	3.	9½.	½.	1½.	" " "	
30.7.22.	7800.	49.	20½.	22½.	5½.	½.	2.	" " "	
	From 30-7-22 quinine grs.xv a day.								
31.7.22.	10000.	37½.	37.	20.	3½.	-.	2.	" " "	
1.8.22.	-	50.	26.	19.	3.	-.	2.	" " "	.3 grm. "914."
2.8.22.	9600.	60.	19.	11.	5½.	1½.	3.	" " "	
3.8.22.	7400.	43½.	30½.	20.	2.	1½.	2½.	" " "	
4.8.22.	9000.	53.	39.	4.	3.	-.	1.	" " "	
5.8.22.	8800.	48.	34.	8.	8.	-.	2.	" " "	
6.8.22.	8000.	59.	11.	21.	7.	-.	2.	" " "	.45 grm. "914."
7.8.22.	10000.	46.	36½.	8½.	5.	1.	3.	" " "	
8.8.22	9800.	53.	18.	22.	4.	2.	1.	" " "	
9.8.22	8800.	53.	27.	13.	6.	-.	1.	" " "	
10.8.22.	11400.	48.	33.	9.	7.	1.	2.	" " "	
11.8.22.	12600.	57½.	26.	7½.	8.	-.	1.	" " "	
12.8.22	7200.	64½.	20.	4.	10.	1.	½.	" " "	
13.8.22.	11800.	65.	24.	4.	5.	-.	2.	" " "	
14.8.22.	8400.	71.	23.	2.	3.	-.	1.	" " "	
15.8.22.	7200.	58.	28.	5.	8.	1.	-.	" " "	

Discharged to duty having gained 12 lbs in weight. To continue with quinine grs.x a day for a month and report on 19-9-22 for injection of "914."

19.9.22.	-	57.	32.	1½.	8½.	-.	1.	No parasites detected.	.45 grm. "914."

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CASE IV.

GORDON A.

On the 30-8-21 patient had an attack of Benign Tertian Malaria at Lahore. Invalided to England on the 16-12-21. Patient has had three relapses whilst at home; the last one on the 18-7-22. Has been treated with quinine prior to admission on 2-8-22. On 6-8-22 had a typical Rigor. Temperature 105 and again on the 7-8-22. Slide showed a double infection of B.T.

G= Gametocytes: S= Shizonts: R= Rings.

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	TREATMENT.
2.8.22	5700.	15½.	68.	12½.	3.	½.	½.	G.4:	
3.8.22	12000.	60.	20.	15½.	3.	-.	1½.	G.1:	
4.8.22	8700.	37.	40.	18.	3.	1.	1.	G.3: R.1:	
5.8.22	8600.	48½.	27½.	10½.	12½.	½.	½.	G.7: R.24:	
6.8.22 10 a.m.	11000.	55.	33½.	6.	4½.	1.	-.	185 in 200 W.Cells counted. Shizonts chiefly.	
Rigor 3 p.m.	4000.	62.	30.	6.	1.	1.	-.	R.90: S.14: G.98 in 100 W.Cells counted.	
4.15p.m. T.103	8600.	82½.	13.	1½.	2.	½.	½.	S.32: G.16:	
6.45p.m. T.100.	10500.	78.	13.	3½.	5½.	-.	-.	S.19: G.4: in 100 W.Cells counted.	
9.15p.m. T.99	9800.	67.	17.	11½.	4.	½.	-.	S.20: G.3: in 100 W.Cells counted.	
7-8-22. 10 a.m.	7800. T.98·4.	47½.	42.	3.	6½.	-.	1.	G.23: in 100 W.Cells.	·45 grm. "914."
Rigor 2.30 p.m.	4200.	69½.	22½.	5.	2½.	½.	-.	S.4:R.7:G.4:	Quinine grs xxx in 24 hr.
7.45p.m. T.100.	6200.	72½.	13.	8.	6½.	-.	-.	G.3:	
8.8.22	4400.	20.	64½.	11.	4.	½.	-.	No parasites detected.	Quinine grs. ~~xxx.~~
9-8-22	6400.	68½.	19½.	5½.	5½.	-.	1.	" " "	" " xv a day
10.8-22.	9000.	55½.	19.	14½.	10.	-.	1.	" " "	" "
11-8-22.	7800.	41½.	50½.	5½.	1½.	-.	1.	G.1:	" "
12.8.22.	11400.	36.	43.	7½.	12.	½.	1.	No parasites detected.	" "
13.8.22.	8200.	15.	78.	2.	5.	-.	-.	" " "	" "
14.8.22.	10000.	74.	14.	4.	4.	-.	4.	" " "	" "
15.8.22.	9000.	50.	40.	5.	3½.	-.	1½.	" " "	" "
16.8.22.	9800.	54½.	31.	2.	6½.	2½.	3½.	" " "	" "
17.8.22.	9000.	47.	41.	2½.	7.	½.	2.	" " "	" "
18.8.22.	10000.	45.	43.	6.	5.	½.	½.	" " "	" "
19.8.22.	8400.	47.	39.	6½.	7.	½.	-.	" " "	" "
20.8.22	7000.	66.	25½.	3½.	3½.	-.	1½.	" " "	" "
21.8.22.	12000.	45.	33½.	10.	7.	1.	3½.	" " "	" "
22.8.22.	10000.	62.	20.	12½.	3½.	-.	2.	" " "	" "
23.8.22.	12200.	57.	28.	5.	6.	1.	3.	" " "	·3 grm. "914."
24.8.22.	9200.	39½.	44½.	9½.	4½.	1.	1.	" " "	Quin. grs. ~~xxx~~ xv a day

CASE IV. (contd.)

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
25.8.22.	10800.	67.	17½.	6.	7½.	-.	2.	No parasites detected	Quinine grs. ~~xxx~~ xv
26.8.22.	7200.	46.	43.	4½.	5½.	-.	1.	" " "	" "
27.8.22.	9400	47½.	43.	7.	2.	-.	½.	" " "	" "
28.8.22.	8200	40.	49½.	3½.	5.	1.	1.	" " "	" "
29.8.22.	7600.	43½.	41½.	7.	6.	-.	2.	" " "	" "
30.8.22.	14200.	43.	43.	4.	9.	-.	1.	" " "	" "
31.8.22.	9600.	59½.	25.	10½.	4.	-.	1.	" " "	" "
1.9.22.	7800.	63½.	27.	5.	3½.	-.	1.	" " "	" "
2.9.22.	9200.	63.	25.	4.	7.	-.	1.	" " "	" "
3.9.22.	11200.	59.	27.	8.	5.	-.	1.	" " "	" "
4.9.22.	9000.	53½.	28½.	8.	8.	1.	1.	" " "	" "
5.9.22.	13600.	58½.	24.	10.	7½.	-.	-.	" " "	" "
6.9.22.	12200.	60½.	26.	5½.	7½.	-.	½.	" " "	.45 grm. "914"
7.9.22.	11400.	58.	21½.	6.	12.	1.	1½.	" " "	Quinine grs. ~~xxx~~ xv
8.9.22.	14200.	60½.	24.	9.	4½.	-.	2.	" " "	" "

Discharged to duty having gained 12 lbs in weight.

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CASE V.

DUNCAN William. Contracted Malaria Benign Tertian in India in August 1920; had three attacks and was invalided to England in April 1922. On the 6-8-22 had a rigor. Report from Central R.A.F. Laboratory:-"Poly 82: S.L.6: L.L.4: L.M.7: Eosin 1: Benign Tertian parasites in all stages."

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
12.8.22.	15000.	58.	26½.	7½.	4.	1.	3.	No parasites detected.	
13.8.22.	15800.	61½.	32½.	2.	2.	½.	1½.	R.1: S.1:	
14.8.22.	12400.	57.	20½.	7.	12½.	½.	2½.	No parasites detected.	
15.8.22.	9600.	66.	22.	4.	6½.	½.	1.	" " "	·3 grm."914."
16.8.22.	12200.	64.	22½.	3½.	7½.	½.	2.	" " "	Quinine grs. xv a day.
17.8.22.	13000.	59.	22½.	9½.	7.	-.	2.	" " "	
18.8.22.	9200.	60½.	27½.	5.	5.	-.	2.	" " "	
19.8.22.	9800.	52½.	31.	8.	7.	½.	1.	" " "	
20.8.22.	12000.	72½.	13½.	7.	3½.	1½.	2.	" " "	
21.8.22.	8200.	63½.	24.	4.	6.	-.	2½.	" " "	
23.8.22.	7000.	68.	19.	6.	5.	-.	2.	" " "	·3 grm."914."
24.8.22.	8400.	57.	20.	8.	10.	1.	4.	" " "	
25.8.22.	10800.	67.	17½.	6.	7½.	-.	2.	" " "	
26.8.22.	12000.	55½.	29½.	8.	6.	1.	-.	" " "	
27.8.22.	-	75.	8½.	6½.	9.	-.	1.	" " "	
28.8.22.	12800.	58.	21.	11.	7.	2.	1.	" " "	
29.8.22.	13200.	64.	22½.	6½.	3.	2.	2.	" " "	
30.8.22.	12000.	60.	21½.	10.	6½.	-.	2.	" " "	·45 grm."914."
31.8.22.	13800.	73.	16.	-.	11.	-.	-.	" " "	
1.9.22.	16000.	73½.	12.	4.	9½.	-.	1.	" " "	
2.9.22.	12800.	60.	26.	7½.	6½.	-.	-.	" " "	
3.9.22.	10400.	53½.	26.	13.	6.	½.	1.	" " "	
4.9.22.	14000.	68.	16½.	5½.	6.	-.	4.	" " "	
5.9.22.	14800.	64.	23.	3.	8.	½.	1½.	" " "	
6.9.22.	15000.	61.	21½.	7½.	7.	1.	2.	" " "	·45 grm."914."
7.9.22.	8400.	62.	23½.	4½.	7½.	1.	1½.	" " "	
8.9.22.	13200.	65½.	20.	5.	6.	-.	3½.		

Discharged to duty having gained 9 lbs in weight.

CASE VI.

SHEPHERD J. Malaria B.T. at Karachi in August 1920. Had Sub-tertian malaria in October 1920. Had about eight attacks in Hospital in India. Returned to England April 1922. Has had several attacks of fever since. Condition on admission. Sallow. Spleen +++ .Has had quinine prior to admission.

DATE.	W.C.C.	P.	S.L.	L.L.	L.M.	B.	E.	Parasites.	Treatment.
25.8.22.	9800.	63½.	20½.	8.	6½.	-.	1½.	B.T.Gametes.	
26.8.22.	-	62½.	15½.	10½.	9½.	2.	-.	G.12.	Quinine grs. xv a day.
27.8.22.	6000.	45.	39.	9.	5½.	-.	1½.	No parasites detected.	
28.8.22.	6600.	56½.	15.	16.	10.	1.	1½.	" " "	
29.8.22.	8000.	41.	25.	26½.	5½.	1.	1.	G.2	
30.8.22.	12400.	35½.	22.	35½.	6.	1.	-.	No parasites detected.	.3 grm. "914".
31.8.22.	14000.	51.	26.	20½.	12½.	-.	-.	" " "	
1.9.22.	15800.	59.	12½.	18½.	10.	-.	-.	" " "	
2.9.22.	9600.	39.	32.	17½.	10½.	-.	1.	" " "	
3.9.22.	7200.	25.	36½.	18½.	18.	-.	2.	" " "	
4.9.22.	10800.	26.	35½.	18½.	18.	2.	-.	" " "	
5.9.22.	12400.	47½.	27½.	14½.	8½.	-.	2.	" " "	
6.9.22.	8200.	51.	32.	12.	4.	½.	½.	" " "	
7.9.22.	10000.	56.	23½.	10½.	8½.	½.	1.	" " "	
8.9.22.	5600.	43½.	34½.	12½.	7½.	-.	2.	" " "	

Discharged to duty greatly improved. To return for further treatment.

SUMMARY.

I. EFFECTS OF QUININISATION.

a. IN CONTROLS. A study of Table I shows a definite Large Mononuclear increase reaching its maximum between the third and fifth day of quininisation. It is reasonable to presume that with the massive doses of quinine prescribed by some clinicians this increase may be even more marked. Quinine in full doses evidently possesses the property of increasing the Large Mononuclear percentage in the circulation. This increase is confined to the Large Mononuclears and does not affect the Large Lymphocytes to any appreciable extent.

b. IN MALARIA. This can only be satisfactorily determined by with holding quinine in Primary cases of malaria. This is hardly justifiable. Three cases were treated, however, for a fortnight with Novarsenobillon alone and three with Quinine Hydrochloride grs.xv a day in addition. They had all had full doses of quinine prior to admission. The following figures were obtained by finding the average percentage in the three cases under discussion.

First week in Hospital. Massive doses of quinine prior to admission. No quinine since admission.

Poly.	S.Lymph.	L.Lymph.	L.Mono.	B.	E.
40·7.	19·9.	23·5.	10·9.	·8	·9

Second week in Hospital. On "914" alone. Results of quininisation passing off.

49·3.	21·4.	21·0.	5·7.	·7.	1·0.

Fourth week in Hospital. Quinine grs.xv a day + "914".

53·6.	26·9.	8·4.	6·8.	·9.	2·1.

It will be noticed that there is a drop in the Large Mononuclear percentage in the second week on stopping quinine followed by a slight rise on its resumption in daily doses of grs.xv. I am convinced that if larger doses of quinine had been given that this rise would be more marked.

DISCUSSION.

A study of the charts of the six cases of malaria selected, at first glance appear to show no marked uniformity in the Blood picture. The percentage of Large Mononuclears is increased as a rule on admission to Hospital, this percentage varies widely from day to day and shows no uniformity in connection with the clinical aspects of the case. It is possible that the high Large Mononuclear counts reported by several observers are due partly to the action of quinine.

Discussion (contd).

Cases 1-4 were treated for some weeks in Hospital and showed marked clinical improvement as evidenced by loss of anaemia and increase in weight. It was noticed in these cases that the percentage of Large Lymphocytes was increased on admission and diminished pari passu with clinical improvement. I would tentatively suggest that this increased percentage of Large Lymphocytes might be of value in the diagnosis and serve as an index in the treatment of malaria. In Case IV a Total White Cell count taken during the actual rigor showed on both occasions a leucopenia followed by a relative leucocytosis during the hot stage.

CONCLUSION.

An increase in the percentage of Large Mononuclears is by no means a constant factor in malaria. It is influenced by quinine administration and is so variable that it possesses little or no value as an aid to diagnosis. The relative increase of the Large Lymphocytes in Malaria and their diminution under treatment is of some value in diagnosis and serves as a control in treatment.

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